Tuberculosis Morbidity and Mortality Facts and Trends

By ROBERT J. ANDERSON, M.D.

THE IMPACT of tuberculosis on our population has undergone remarkable changes in the recent past. Deaths from tuberculosis continue to decline, and illness is somewhat less frequent and of shorter duration. Current facts and trends may make clear some of the directions effort must take to accomplish a continuing control of tuberculosis.

The complexity of morbidity reporting limits good detailed data on the subject to recent years. Mortality data, however, being simpler to collect if not as rich in meaning, are available in much longer series and much more detail.

The number of deaths (fig. 1) from tuberculosis has declined between 15 percent and 20 percent each year for the last few years. In spite of this decline, provisional tabulations show that for 1954 there were 17,000 deaths from tuberculosis in the United States, a rate of 10.5 per 100,000 population. For the first quarter of 1955, the decline appears to be somewhat retarded, with a death rate about 10 percent less than that in the first quarter of 1954.

Deaths measure only one aspect, though an important one, of the impact of tuberculosis upon our population. The death rate has never been a precise index of the trend of the tuberculosis problem, and today its usefulness is more limited than in former years. But, in recognizing the limitations of mortality as an index of trends, its usefulness as an indication of the relative influence of the disease on various population groups should not be ignored.

The number of new cases reported now constitutes one of the best indexes of the trend of tuberculosis although a decade ago reporting was so inadequate in many places as to make this measure virtually useless. In the last several years there has been approximately a 3 percent decline in the number of new cases reported per year. At this rate, more than a quarter century will be required to equal the same percent reduction realized in mortality in the last 5 years alone. The prospect of even this achievement is beclouded by one recent observation. Preliminary morbidity reports for the first 3 or 4 months of 1955 from two-thirds of the United States show an increase of 2 percent in new tuberculosis cases. A portion of this increase may be due to additional case finding. There is need for further study to determine whether there are other reasons for the increase.

Dr. Anderson, assistant chief for operational research, Division of Special Health Services, Public Health Service, presented this paper at the annual meeting of the National Tuberculosis Association, held at Milwaukee, May 26, 1955.

Tuberculous Meningitis

Tuberculous meningitis, not to be compared with respiratory tuberculosis in the number of lives it has taken, has nevertheless been an important index of the degree of control of the

whole tuberculosis problem. A low tuberculous meningitis death rate has been considered an index of success in preventing the spread of the tubercle bacillus. Two-thirds of such deaths occur among children under 15. From 1900 to 1920, there was little decline in tuberculous meningitis death rates. From 1920 to 1940, the drop was almost precipitous, as compared with the gradual decline in respiratory tuberculosis rates. This was about the time when the number of tuberculosis beds began to climb. It was a matter of considerable concern that from 1944 to 1950 there was a leveling off in the number of deaths due to tuberculous meningitis. Fortunately, there has been a substantial decline in the last 3 years, doubtless because of improved techniques of present-day drug therapy.

Now that the case-fatality rate for tuberculous meningitis has been dramatically reduced, this death rate is no longer a useful index of the adequacy of a tuberculosis control program. Accurate data on the incidence of tuberculous meningitis, however, would still be a useful index for that purpose.

Age, Sex, and Race

Tuberculosis as a disease is still very much a foe of young adults (fig. 2). Although the rate is low in children, it rises sharply in the 15- to 24-year age group and continues to increase gradually with age. For the entire United States half of the newly reported active cases are patients under 42 years of age. Thus the frequency of the disease among young adults who respond very favorably to present-day drug therapy is a matter of significance for tuberculosis program planning.

Figure 1. Newly reported tuberculosis cases and tuberculosis deaths, United States, 1930–54.

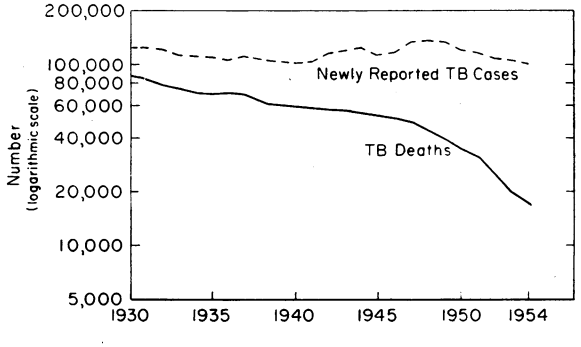


Figure 2. Age-specific rates for newly reported active and probably active tuberculosis cases and tuberculosis deaths, United States, 1953.

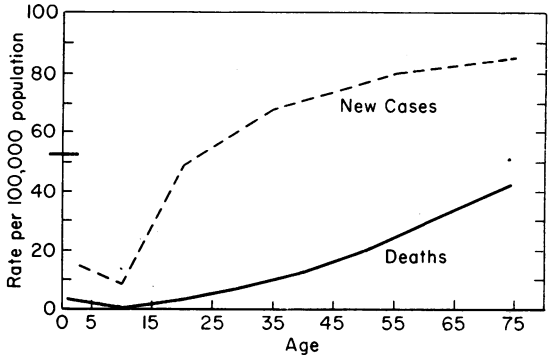
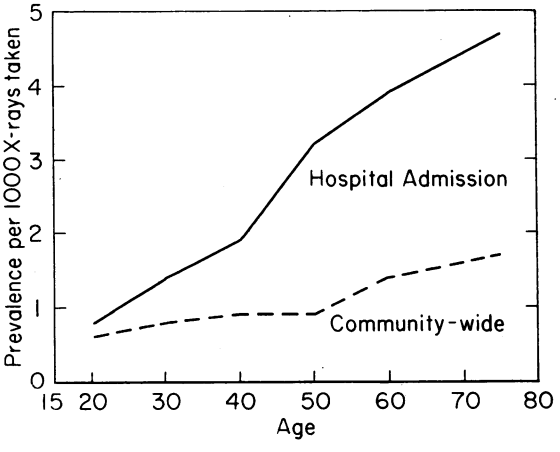


Figure 3. Active tuberculosis cases per 1,000 X-rays taken in communitywide and hospital admission X-ray programs.



While a large proportion of all tuberculosis cases are reported among the younger part of our population, the case rates are higher in the older age groups. Moreover, the rates of newly reported tuberculosis cases for older people show little decline from year to year. In fact, in the age 65 and over group, a slight increase was shown for 1953. High morbidity rates for those in the older age groups are also found in communitywide surveys and in hospital admissions X-ray screening programs (fig. 3).

In the past half century (fig. 4) the decline in tuberculosis mortality by age has been most marked in infants under 1 year of age. In the first decade of the century, infants under 1 year of age had a higher tuberculosis death rate than

any other age group. In recent years this group has had a lower death rate than has any of the adult age groups.

From 1930 to 1950, there was relatively little drop in tuberculosis death rates in the older age groups, but in the last few years, the decline has been quite marked. Even more rapid has been the decline in death rates for those under 25.

Rates of newly reported active cases of tuberculosis by sex and race continue to demonstrate somewhat the same pattern as in former years. Rates for white males are approximately twice those for white females. Rates for nonwhites are approximately three times as high as for whites. Yet, in six States, the tuberculosis case rates are higher for white males than for nonwhite females, and further, the number of cases reported for white males (fig. 5) is almost as great as the number for the other three groups combined.

The proportionate decline in death rates has been much greater in recent years among fe-

Figure 4. Age-specific tuberculosis death rates, United States, 1900–1953.

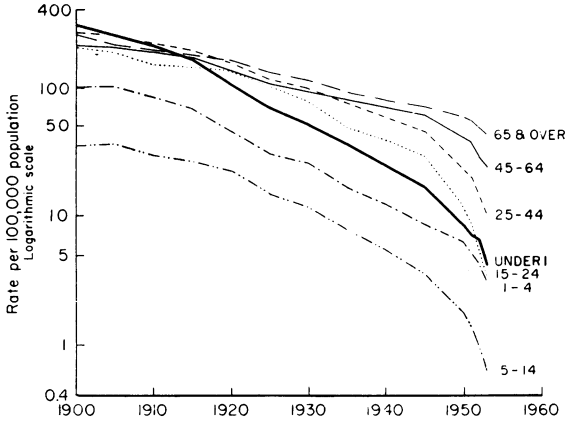


Figure 5. Race and sex of newly reported active and probably active tuberculosis cases, United States, 1953.

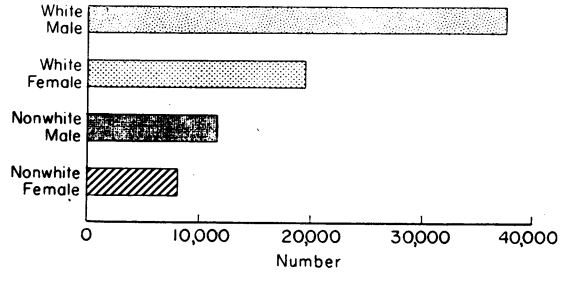


Figure 6. Race and sex-specific tuberculosis death rates, United States, 1940–54.

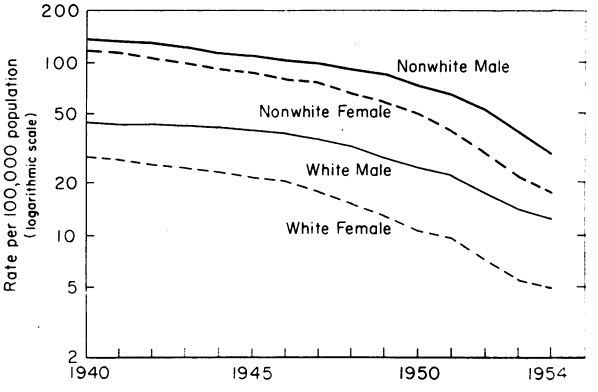
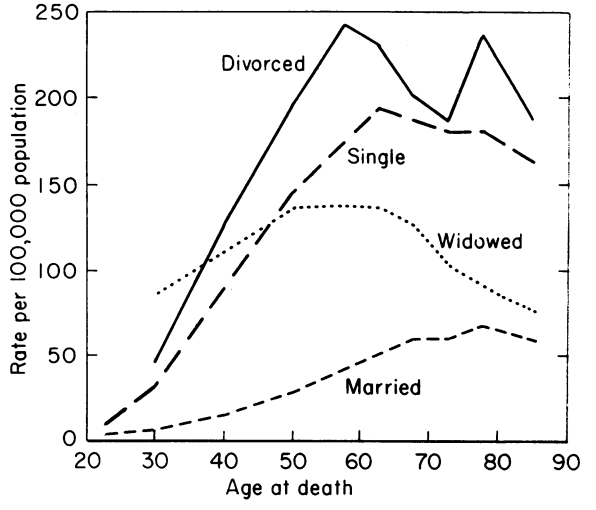


Figure 7. Marital status, age-specific tuberculosis death rates for white males, United States, 1949–51 average.



males than among males (fig. 6). If this trend continues for another 5 years, white males will have a higher tuberculosis death rate than nonwhite females.

Marital and Economic Status

Generally, death rates from all causes are definitely higher for the unattached than for the married (fig. 7). Tuberculosis death rates are much higher for single, widowed, and divorced people than for married persons.

The close relationship between tuberculosis mortality and economic status has been generally recognized. However, when the prevalence of unreported tuberculosis in terms of

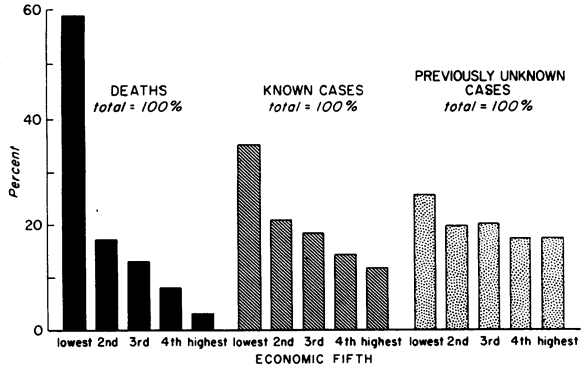
economic status is examined, this relationship is not so marked. For example, in a study made in Cleveland, Ohio, it was learned that tuberculosis mortality was almost 20 times as great in the lowest economic group as in the highest (fig. 8). However, previously unknown tuberculosis cases in the lowest economic group were only about 1.5 times as great as in the highest. It seems reasonable, therefore, to conclude that low economic status and tuberculosis each tend to beget the other.

This suggests the need for study of the social, psychological, economic, and nutritional factors which have been recognized as being important in the development of tuberculosis. It also suggests the need for directing case-finding activities. It is not sufficient to search for cases among the population groups which have the highest death rates. It is better to search among the groups with the highest prevalence rates, but undue emphasis may result in missing the large number of cases in those groups that have lower prevalence rates but large numbers of people.

Geographic Distribution

Tuberculosis death rates generally are high in the large cities. Cities of 100,000 population and over have a tuberculosis death rate approximately 80 percent higher than that of the remainder of the country. In fact, when the death rates for each State, exclusive of the large cities, are computed, there are only four States—Arizona, Tennessee, Arkansas, and Kentucky—which have death rates higher than the average rate for the large cities. Maryland is one of the States with a fairly high tuberculosis death rate, yet, when Baltimore is excluded, its death rate in 1953 was below 10 per 100,000 population. Maryland exclusive of Baltimore has a lower rate than do any of the States nearby with their large cities excluded. When the large cities in Michigan, Wisconsin, and Minnesota are excluded, those States compare quite favorably with the other middle western States and the Mountain States exclusive of large cities. People who live in the suburbs have a death rate less than half the rates in the large cities. Small cities, unincorporated urban areas, and rural areas have the lowest rates.

Figure 8. Percentage distribution of deaths from tuberculosis, known cases and previously unknown cases, by economic fifth, Cuyahoga County, Ohio.



Morbidity rates are lowest in some of the States in the western plains and Rocky Mountains. A fairly close parallel exists between reported cases and deaths by States (figs. 9 and 10). The decline in mortality has been without any apparent geographic pattern (fig. 11). Some States which had low tuberculosis death rates in 1947 also had the least percentage decline, while other States with moderately low death rates showed the greatest improvement. A similar variation in decline occurred in the group of States with high death rates.

Case Finding and Reporting

The relative slowness with which the rate of newly reported cases has declined has been the object of considerable curiosity. Reporting was very inadequate in many States before 1947, and during the period 1947 to 1949 morbidity reporting was inflated by the inclusion of cases of borderline clinical significance. For recent years, however, rates of newly reported cases are generally not inflated. The evidence for this is twofold: First, approximately 37 percent of new active cases had positive sputum at the time of report; second, 78 percent of the cases were reported as either moderately advanced or far advanced. There is no appreciable change from the preceding decade.

Further evidence of the persistently high incidence of tuberculosis is in the number of admissions to tuberculosis hospitals. These have done little more than fluctuate in the period from 1947 to 1953 in several large States for which data are available. Vacancies in beds are

Figure 9. Newly reported active and probably active tuberculosis cases per 100,000 population (provisional data), United States and Territories, 1954.

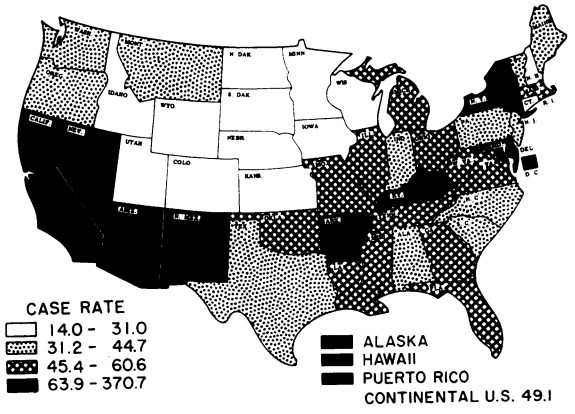
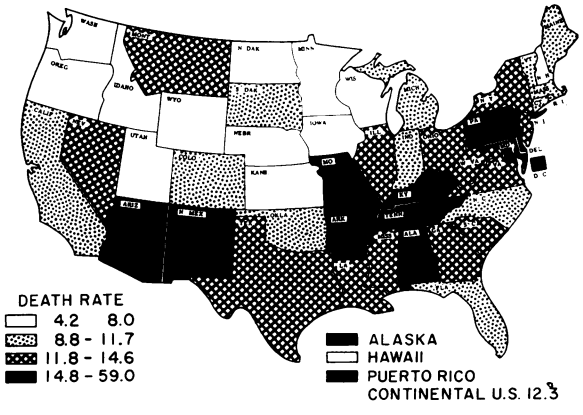


Figure 10. Tuberculosis deaths per 100,000 population, United States and Territories, 1953.



probably due more to reductions in duration of stay than to decreases in admissions.

Tuberculosis case finding and reporting now are definitely superior to that of previous decades. For example, almost one-third of reported cases are found by X-ray survey. Fewer cases are first reported by death certificate. Even now, however, more than one-fourth of tuberculosis deaths were never reported as living cases. Large numbers of cases are not reported until the report of the sanatorium admission is received by the health department. The number of cases that remain unreported because they are not referred for sanatorium admission is not known. While progress has been made in reducing the proportion of cases first reported in the far-advanced stage to 37 percent, it would seem reasonable to expect a further movement of reported cases from the far-advanced category to the moderately advanced category provided case-finding and case-reporting efforts are not relaxed.

Usually cases are diagnosed as tuberculous before they are referred for hospitalization, and in such instances the cases should be reported to the health department by some source other than the tuberculosis sanatorium. Even so, in 10 States, 40 to 60 percent of the reports of new active cases come from the sanatorium. It is at least questionable that the reporting systems in these States are adequate. In any event, the reporting of cases should be evaluated in the light of the specific practices in any given area.

To find as many cases in early stages of the disease as possible is a most worthwhile and desirable goal, but it is questionable that early case finding can be judged solely in terms of the proportion of new cases which are minimal in extent. The duration of time in which tuberculosis may progress from minimal to advanced may be very short, and present-day diagnostic procedures are such that it is difficult to discover active cases before they become moderately advanced. In order to prove tuberculosis by demonstration of tubercle bacilli from sputum, or gastric or bronchial lavage, necrosis of the lung must have set in, which means that a cavity is being formed. When a cavity can be seen on an X-ray, the case is no longer minimal in extent but must be classified at least as moderately advanced. Obviously, this frequently

Figure 11. Percentage decline in tuberculosis deaths per 100,000 population, United States and Territories, 1947–53.

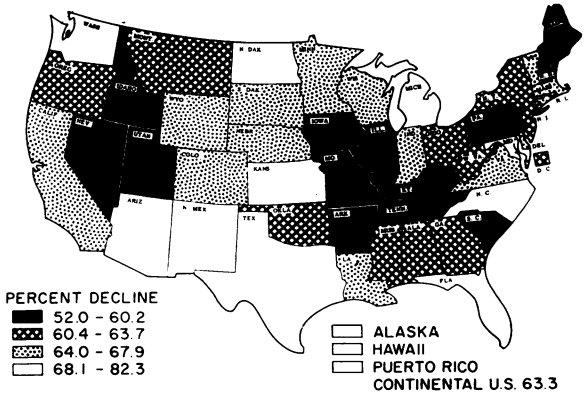
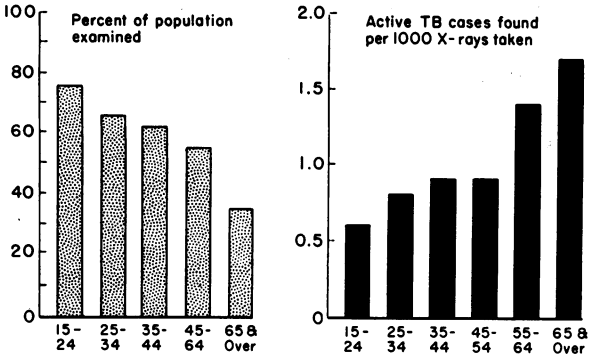


Figure 12. The age groups with the most tuberculosis not reached in communitywide chest X-ray surveys.



leaves a fine line between minimal and moderately advanced disease.

With the emphasis upon reporting active and probably active cases, there is a built-in bias against the reporting of minimal tuberculosis cases. From a practical viewpoint, treatment is not recommended for the minimal inactive cases.

In spite of the difficulties of diagnosing tuberculosis before it has extended, it is still the responsibility of tuberculosis control workers to put forth all possible efforts to use effectively the presently available means for diagnosis. For example, communitywide surveys and other X-ray case-finding programs have generally been successful in the various States, and many millions of people have been X-rayed. However, the surveys have not been as successful as might have been hoped (fig. 12). The older age groups in which the rate of active tuberculosis is greatest have not been adequately covered.

Prevalence

Current information indicates that there are somewhat less than 400,000 active tuberculosis cases in the United States at any one time, approximately one-third of which are hospitalized for tuberculosis, one-third are known cases at home, and one-third are undetected cases.

Several studies in progress indicate that the total number of known active cases is definitely declining. How great this decline is cannot now be accurately measured; but some precise information is available concerning known tuberculosis cases hospitalized at any one time, or the beds the patients occupy. On April 1, 1954, there were 2 percent fewer patients hospitalized for tuberculosis than a year earlier. A study by the National Tuberculosis Association and the Public Health Service, in November 1954, of a large number of tuberculosis hospitals shows a further decline of 6.7 percent. However, the number of patients hospitalized for tuberculosis in November 1954 was greater than at any time prior to 1950.

The number of known active cases at home appears to be declining. Before the days of chemotherapy, the majority of patients discharged from sanatoriums continued to have active disease at home for a substantial period of time. Today, most patients discharged from the sanatorium are discharged with arrested or inactive disease. A substantial proportion of these patients continue to receive chemotherapy at home for a period of months or years after sanatorium discharge. Thus, even though the number of known active cases at home may be declining, the demands upon health department services are actually increasing. These cases, arrested but continuing on drug therapy, will actually require more public health supervision from health department staffs, public health nurses in particular, than corresponding patients received a decade ago. Current studies show a very marked inadequacy of public health supervision and treatment of the known tuberculosis cases who are at home. Although the prevalence of tuberculosis in unattached males, migrants, and other special groups presents a challenging problem, there are numerically more known tuberculosis cases at home in other categories who are not getting control services.

Infection Rates

The number of persons infected with tubercle bacilli is not known. Relatively little of the tuberculin testing now being done provides adequate information concerning infection rates. Several studies are in process and are being planned for this purpose. One such study in the District of Columbia shows an infection rate of only 3 percent for 7-year-old children of all races combined. It is certain, however, that

there are millions of individuals in the United States today, possibly 50 million, who are infected with tubercle bacilli. It is necessary, however, to learn more about the changes which are occurring in new tuberculous infections in the many social, biological, and geographic segments of our population.

Looking Forward

It is hazardous to risk predictions of trends in any field, particularly in tuberculosis. Yet the future is a lure difficult to resist. So marked has been the decline in the death rate of tuberculosis in the past 10 years that to many its disappearance as a public health problem seems an eventuality of an immediate tomorrow. Such optimism is a trap into which even the most guarded minds have fallen, and from them frequently comes the question, "How much longer shall we continue to exert tuberculosis control efforts?"

Despite the unreality of setting an end point for tuberculosis as a public health challenge, an intermediate goal can arbitrarily be selected for the sake of argument, and time limits can be drawn to emphasize the continuing magnitude of the problem.

Even in terms of death rates alone the future task is large and prolonged. It will require years of effort to achieve a death rate of only 1.5 per 100,00 population, which is about the current death rate from acute rheumatic fever, appendicitis, arthritis, poliomyelitis, and several other diseases which are still considered to be of public health import. The maternal mortality rate is about at that level. Measles, whooping cough, and infectious hepatitis combined do not exceed it. When the death rate from tuberculosis drops to the level of these important diseases, then tuberculosis control programs and needs should be reexamined.

Indeed, if conditions remain the same, and if control activities are so maintained that the rate of decline in mortality will equal that of the past 5 years:

It will be 11 years before the crude tuberculosis death rate is 1.5 per 100,000 population; 7 years before this death rate is achieved for white females; between 10 and 15 years, for nonwhite males and females, and white males; and 25 years before the age group over 65 has a death rate of 1.5 per 100,000 population.

The task of defeating tuberculosis is plainly not done. Persisting cases of tuberculosis, especially those out of hospitals, challenge every ingenuity in planning the content and scope of control programs of tomorrow.

Armed Services Medical and Dental Symposium

A 3-day symposium, sponsored by the First Naval District, Boston, Mass., on developments in military medicine and dentistry with special emphasis on atomic warfare, special weapons, and isotopes has been scheduled for March 21–23, 1956.

The first meeting will be held at the United States Naval Hospital, Chelsea, Mass. On the mornings of the second and third days, clinics will be scheduled at various hospitals in Boston on the treatment of disease with radioactive isotopes. Afternoon lectures will be given at the Jimmy Fund Foundation Building and at the New England Deaconess Hospital.

Programs and additional information may be obtained from the District Medical Officer, First Naval District, 495 Summer Street, Boston 10, Mass.